eye, and held horizontal nearly on a level with the eye, the true relations will appear. Fig. 11 is valuable for its conclusive demonstration that the deviation is proportional to the angle; the increasing angles gradually bend the straight lines away from one another, and give them the gradual change of direction of curves. These and other forms of illusion are all included in the generalization that the sides of an angle are deviated towards the direction of that angle.[1]

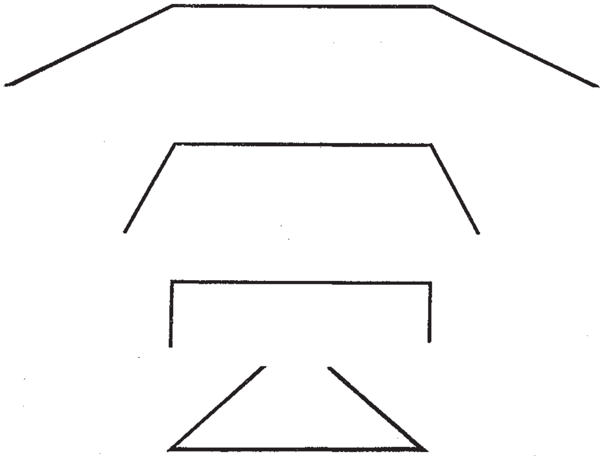

FIG. 12.

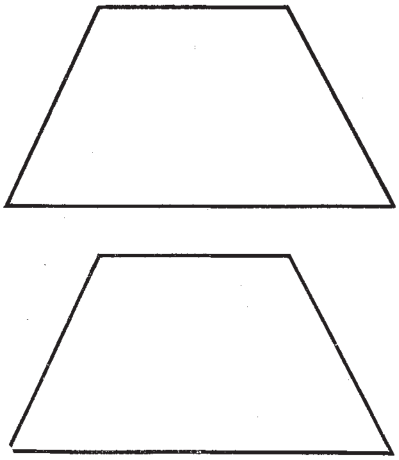

FIG. 13.

The psychological principle with which this generalization may be correlated is the law of relativity. This law emphasizes the fact that a sense-impression is not the same when presented alone and when in connection with other related sense-impressions. We cannot judge the direction of lines independently of that of the angles whose sides they form. As a further illustration of this principle it may be shown that angles will affect the apparent *lengths* of lines as well as their apparent *directions*. If in Fig. 12 we compare the horizontal portion of the uppermost figure with that of the lowest, it is almost impossible to believe that they are of equal length. The intermediate horizontal lines seem intermediate in length, and thus illustrate the fact that the apparent length of the horizontal lines is directly proportional to the size of the angles at their extremities. The illusion would persist if we converted these figures into truncated pyramids by adding a line parallel to the horizontal line, and would then illustrate the fact that equal lines may be made to appear unequal by the effect of the areas whose contours they help to form. A converse effect is illustrated in Fig. 13. Here the upper figure seems larger than the lower, because its larger parallel side is brought into juxtaposition with the smaller parallel side of the lower figure. This illusion and others show especially well when cut out of paper and held against suitable backgrounds. As the figures are moved about one another the upper constantly becomes the larger. More than two figures may be used, and a variety of such contrasts may be formed.

The subject is by no means fully considered in these illustrations nor is the explanation offered as final or adequate. If it seems to direct investigation into fruitful paths its chief purpose will be accomplished.

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[1] The reader is referred to the original paper for further illustration of this dictum, as well as for explanations of apparent exceptions and a discussion of the conditions affecting it.

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## *THE NEW SATELLITE OF JUPITER.*

THE new number of the *Astronomical Journal* contains Mr. Barnard's account of his discovery of this additional member *of our system*. We make the following extracts:—"Nothing of special importance was encountered until the night of September 9, when, in carefully examining the immediate region of the planet Jupiter, I detected an exceedingly small star close to the planet, and near the third satellite. I at once suspected this to be a new satellite. I at once measured the distance and position-angle of the object with reference to satellite three. I then tried to get measures referred to Jupiter, but found that one of the wires had got broken out and the other loosened. Before anything further could be done the object disappeared in the glare about Jupiter. Though I was positive the object was a new satellite, I had only the one set of measures, which was hardly proof enough for announcement. I replaced the wires the next morning. The next night with the great telescope being Prof. Schaeberle's, he very kindly gave the instrument up to me, and I had the pleasure of verifying the discovery, and secured a good set of measures at elongation. In these observations, and those of the succeeding night, only distances from the following limb of Jupiter could be measured. These were observed with the wires set perpendicular to the belts. The planet was thrown outside the field, the satellite bisected, and then the limb brought in and bisected also. This method would not permit any measures from the poles of the planet for latitude. On the 12th I inserted a strip of mica, carefully smoked, in front of the field-lens, for occulting the planet. This served admirably, permitting the satellite and planet to be both seen at once, and measures from the polar limbs could be made with great ease. The observations of the satellite from the 12th were all thus made.

"To avoid any personal equation I have on each night measured the diameters of the planet, for use in reducing the observations to the centre of Jupiter. Since the 12th, these have been measured through the smoked mica, so as to avoid introducing any error from the reduced brightness of the planet. The diameters were measured by the method of double distances. Just what the magnitude of the satellite is, it is at present quite impossible to tell. Taking into consideration its position, however, in the glare of Jupiter, it would, perhaps, not be fainter than the thirteenth magnitude. It will only be possible to settle this question with any certainty by waiting until some small star of the same magnitude is seen close to Jupiter, and then after determining its magnitude when away from the planet. In general the satellite has been faint—much more difficult than the satellites of Mars. On the 13th inst., however, when the air was very clear, it was quite easy.

"It is scarcely probable that this satellite will be seen

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with anything less than twenty-six inches, and only with that under first-class conditions. I give here the observations that I have so far obtained, and defer any suggestions as to a name until a later paper. It certainly should not disturb the present harmony existing in the Roman numerals already applied to the satellites.

"It is so wholly different from any of the other moons in physical aspect, that it ought, in a sense, to be considered independent of them, and simply be called, say, the fifth satellite, with a suitable mythological name.

"It will be seen that on three of the dates of observation the east elongation is well covered in the measures."

Plotting the observations at elongation, the following values of the distance were obtained:—

| | | | From Jupiter's centre. Miles. |
|---|---|---|---|
| September 10 (apparent) | 61″·04 | log R = 7·08267 | 112250 |
| ,, 12 ,, | 61″·55 | ,, 7·08452 | 112750 |
| ,, 14 ,, | 61″·60 | ,, 7·08324 | 112400 |

From these the following periods result, using the well-known formula:—

$$P = p \sqrt{\frac{m}{M} \frac{R^3}{r^3}}.$$

| | h. | m. |
|---|---|---|
| September 10 period ... ... | 11 | 47·6 |
| ,, 12 ,, ... ... | 11 | 52·3 |
| ,, 14 ,, ... ... | 11 | 49·0 |
| Mean ... ... ... | 11 | 49·63 |

The observations, all made in standard Pacific time (eight hours slow of Greenwich) are given at length in the *Journal*.

The latitude measures show that the satellite's orbit lies in the plane of Jupiter's equator, and Mr. Barnard holds that it is consequently a very old member of Jupiter's family, "since it would doubtless take ages for the orbit to be so adjusted."

W. L.

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## NOTES.

The ordinary general meeting of the Institution of Mechanical Engineers will be held on Wednesday evening, October 26, and Thursday evening, October 27, at 25, Great George Street, Westminster. The chair will be taken at half-past seven p.m. on each evening by the President, Dr. William Anderson, F.R.S. The ballot lists for the election of new members, associates, and graduates having been previously opened by the Council, the names of those elected will be announced to the meeting. The nomination of officers for election at the next annual general meeting will take place. The following papers will be read and discussed, as far as time permits:—Second Report of the Research Committee on the value of the steam-jacket, by Mr. Henry Davey, Chairman (Wednesday); and experiments on the arrangement of the surface of a screw-propeller, by Mr. William George Walker, of Bristol (Thursday).

We are asked to intimate that the late Prof. Adams has left a number of separate copies of certain of his mathematical and astronomical papers, and that Mrs. Adams will be happy to distribute them to scientific friends who make application for them by letter addressed to her at 4, Brookside, Cambridge.

The Harveian oration was delivered on Tuesday afternoon by Dr. J. H. Bridges. He presented an able and most interesting sketch of the scientific influences amid which Harvey's work was done, and the relation of his great discovery to later research.

The controversy as to vivisection is still going on in the *Times*. For the present, therefore, it may be enough for us to reproduce the letter which was signed by Sir Andrew Clark, Sir James Paget, Dr. Samuel Wilks, and Sir George Humphry, and printed in the *Times* on Saturday last. It is as follows:—"Having already expressed our views, personally or by letter, to the Church Congress, we decline to enter into any further public discussion on the question of so-called 'vivisection,' for the following reasons, the statement of which we make solely because we think it is due to your readers:—Firstly, after full consideration, we are satisfied that the scientific aspect of this question cannot receive adequate and just treatment in the columns of a newspaper. Secondly, because it is hardly possible for us to name any progress of importance in medicine, surgery, or midwifery which has not been due to, or promoted by, this method of inquiry."

Prof. Virchow was invested, on Saturday last, with the insignia of office as Rector of the University of Berlin. He chose "Learning and Research" as the subject of his address. He acknowledged that study had contributed greatly to create a mutual basis of understanding and a common educational foundation for the peoples of Europe, strengthening at the same time the idea of consanguinity. That state of things, however, was, he thought, entirely changed, and he contended that the turning-point in the supremacy of the classical languages had been reached. "A grammatical education is not the means for progressive development demanded by our youth. Mathematics, philosophy, and the natural sciences give young minds so firm an intellectual preparation that they can easily make themselves at home in any department of learning."

Prof. Berg has succeeded the late Dr. Burmeister as director of the National Museum in Buenos Ayres.

Dr. G. v. Lagerheim, at present director of the Botanic Garden at Quito, Ecuador, has been appointed curator of the museum at Trömso, Norway.

Mr. W. G. Ridewood, B.Sc., of the Royal College of Science, South Kensington, Assistant to the Director of the Natural History Museum, has been appointed Lecturer in Biology to the St. Mary's Hospital Medical School.

The October number of the *Kew Bulletin* opens with a section giving some interesting information as to Lao tea. Some time ago a singular method of using the leaves of what has since been proved to be the Assam tea plant of commerce (*Camellia theifera*) was brought before the Society of Arts by Mr. Ernest Mason Satow. Amongst the Laos, a people inhabiting a district of Siam, in the neighbourhood of Chiengimai, the tea leaves are not used for making an infusion as in other countries, but are prepared wholly for the purpose of chewing. The leaves are first steamed and then tied up in bundles and buried in the ground for a period of about fifteen days. Leaves thus prepared, called locally "mieng," are said to keep for two years or more. The habit of chewing "mieng" is almost universal among the Laos, and to men engaged in hard work, such as poling or rowing, it is said to be almost indispensable. The *Bulletin* prints a correspondence in which the result of an inquiry made by Kew in regard to the plant yielding "mieng" and the method of preparation is detailed.

The other sections in the October number of the *Kew Bulletin* deal with Chinese silkworm gut; mangrove bark and extract; Burmese black rice; Mauritius tea; potato disease in Poona; British North Borneo; and Allouya tubers. There are also some miscellaneous notes.

We learn from the *Journal of Botany* that Dr. H. Trimen, F.R.S., the Director of the Botanic Gardens at Paradeniya Ceylon, has received the sanction of the Government to proceed with the publication of the flora of that island. The work will be published in parts by Messrs. Dulau and Co., and will form two vols. octavo, together with a quarto atlas of 100 coloured plates,

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